EAGLE
&
MULTIPLE FOM'S

Sponsor:

OSD PA&E

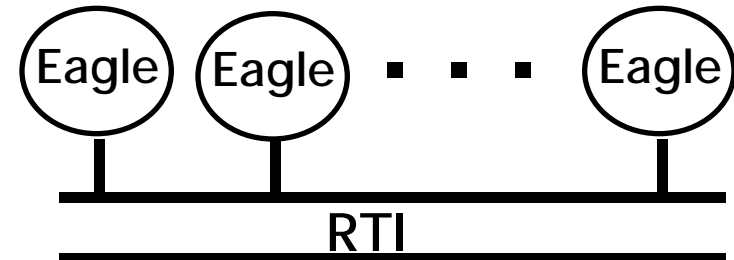U.S. Army TRADOC Analysis Center

Jack Ogren

Apr 1997

MITRE

Eagle & the HLA
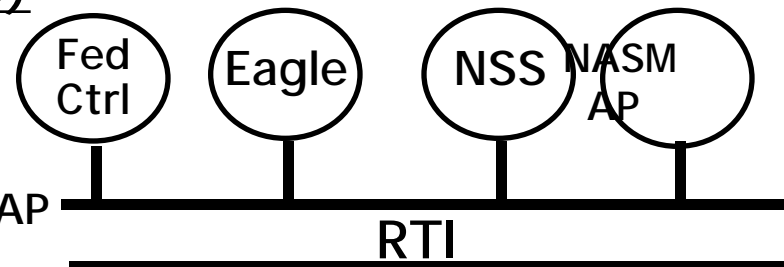# Summary of Effort - 3 Separate Federates

Eagle Early Analysis Experiment

Distributed Units -
Eagle Combat units interact
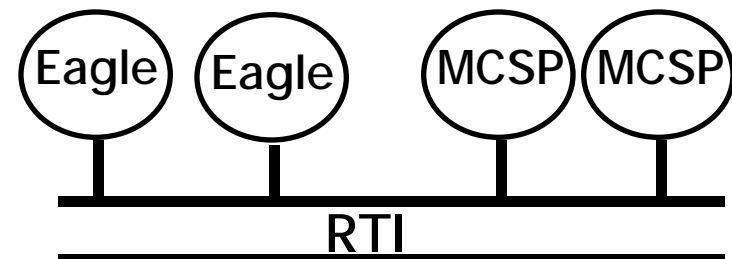using the RTI.

Eagle Eagle ▪ ▪ ▪ Eagle

RTI

Joint Training Federation (JTFp)

Distributed Functionality-
Army Combat units - Eagle
Navy Combat units - NSS
Air Force Combat units - NASM AP
Federation Controller

Fed Ctrl   Eagle   NSS   NASM AP

RTI

Eagle to MCSP/Beta - WarLab

Eagle Combat Hqs divest
Cognitive Processing to
Live Players using MCSP
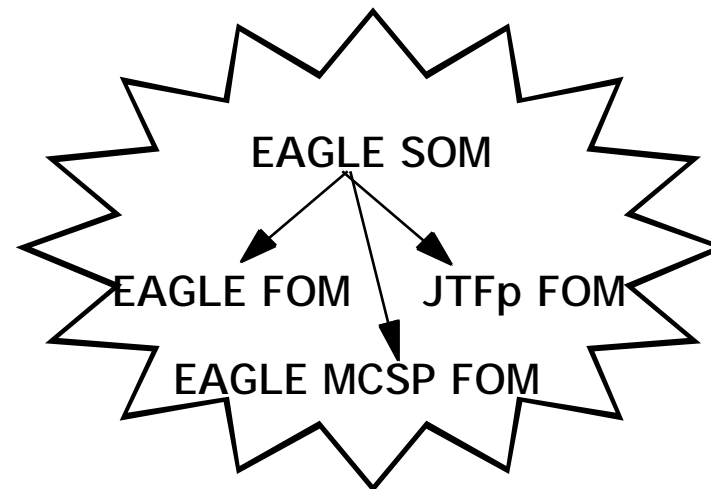
Eagle Eagle   MCSP MCSP

RTI

Contexts
Eagle & the High Level Architecture

❹ Class Structures

O Interactions

O Summary

Software Object Model
and
Federation Object Model

EAGLE SOM

EAGLE FOM   JTFp FOM

EAGLE MCSP FOM

Eagle Class Structure
Normal structure in model (one example)

BLUE-BDE-CP	STAFF	LOG-MANAGER			
		LOG-ISSUER			
		HQ-UNITS	GROUND-MOVERS	ADA-FIRERS	
				ARMY-UNITS	
				MILITARY-UNITS	LOG-RECEIVER
					PURGE-UNITS
	SIGNATURE-GROUND-MOVERS	SIGNATURE			
	RES-BATTLE-OPERATIONS-GROUND-MOVERS	RES-BATTLE-OPERATIONS-MILITARY-UNITS	RES-BATTLE-OPERATIONS		
	DIRECT-FIRE-INFO-MILITARY-UNITS	DIRECT-FIRE-INFO			
	ENGR-INFO-MILITARY-UNITS	ENGR-INFO			
	RES-EFFECTIVENESS-MILITARY-UNITS	RES-EFFECTIVENESS			
	AD-INFO-HQ-UNITS	AD-INFO-MILITARY-UNITS	AD-INFO		
	CMD-PLANNING-HQ-UNITS	CMD-PLANNING			
	COMMO-HQ-UNITS	COMMO-GROUND-MOVERS	COMMO-MILITARY-UNITS	COMMO	
	CP-BATTLE-OPERATIONS-HQ-UNITS	CP-BATTLE-OPERATIONS			
	CP-DECISION-FACTORS-HQ-UNITS	CP-DECISION-FACTORS			
	CP-EFFECTIVENESS-HQ-UNITS	CP-EFFECTIVENESS			
	GENERAL-HQ-UNITS	GENERAL-MILITARY-UNITS	GENERAL		
	INDIRECT-FIRE-INFO-HQ-UNITS	INDIRECT-FIRE-INFO-MILITARY-UNITS	INDIRECT-FIRE-INFO		
	INTEL-HQ-UNITS	INTEL-MILITARY-UNITS	INTEL		
	MEMORY-HQ-UNITS	MEMORY-GROUND-MOVERS	MEMORY-MILITARY-UNITS	MEMORY	
	METHOD-MAPS-HQ-UNITS	METHOD-MAPS-GROUND-MOVERS	METHOD-MAPS-MILITARY-UNITS	METHOD-MAPS	
	MOVEMENT-HQ-UNITS	MOVEMENT-GROUND-MOVERS	MOVEMENT-MILITARY-UNITS	MOVEMENT	
	PERCEPTIONS-HQ-UNITS	PERCEPTIONS-MILITARY-UNITS	PERCEPTIONS		
	RES-DECISION-FACTORS-HQ-UNITS	RES-DECISION-FACTORS-GROUND-MOVERS	RES-DECISION-FACTORS-MILITARY-UNITS		
			RES-DECISION-FACTORS-ARMY-UNITS		
	SUPPLY/PERSONNEL-LOG-MANAGER	SUPPLY/PERSONNEL			

A bottom level class.

Instances would be created and attached to this class

The instances would inherit from all the objects to the right

This entire Class structure feeds into the bottom level Class (BLUE-BDE-CP)

Eagle Class Structure ❹ Eagle SOM ❹
Distributed Eagle FOM   &&   JTFp FOM

Distributed Eagle FOM
(partial)

Base Class	1st SubClass	2nd SubClass
Military Units	Ground Movers	
	Air Movers	Air Maneuver
		Fixed Wing

JTFp FOM
(partial)

Base Class	1st SubClass	2nd SubClass
Player	Air Player	Ballistic Missile
		Aircraft
		Flight
	Ground Player	Fixed Site
		Mobile Ground
		Aggregate Ground
	Float Player	

Eagle SOM Class Structure
(partial)

Eagle SOM - Partial Class Structure

MILITARY UNITS
AIR-MOVERS
- FIXED-WING-UNITS
  - AIR-SENSOR-UNITS
  - BLUE-AIR-FLIGHT
  - RED-AIR-FLIGHT
  - FIXED-WING-ATTACKERS
    - BLUE-FL...
    - RED-FLI...
- HELICOPTER-UNITS
  - BLUE-HELO-BN
  - BLUE-HELO-CO
  - RED-HELO-BN
  - RED-HELO-CO
- AIR-DEFENSE-UNITS
  - BLUE-AD-UNIT
  - RED-AD-UNIT
- ENGINEER-UNITS
  - B-CBT-ENGR-TM
  - B-CBT-HVY-ENGR-TM
  - R-CBT-ENGR-TM
  - R-GP-ENGR-TM
- ARTILLERY-UNITS
  - BLUE-ARTY-BN
  - BLUE-ARTY-BATTERY
  - RED-ARTY-BN
  - RED-ARTY-BATTERY
- GROUND-SENSOR-UNITS
  - BLUE-GROUND-SENSOR-UNIT
  - RED-GROUND-SENSOR-UNIT

GROUND-MOVERS
- GROUND-MANEUVER-UNITS
  - BLUE-BN-TF
  - RED-MRR-BN
  - RED-TANK-BN
  - BLUE-CO
  - RED-CO
- HQ-UNITS
  - BLUE-CORPS-CP
  - BLUE-DIV-CP
  - RED-ARMY-CP
  - RED-DIV-CP
  - BLUE-BDE-CP
  - BLUE-BN-CP
  - BLUE-ENGINEER-CP
  - RED-REGT-CP
  - RED-BN-CP
  - RED-ENGINEER-CP

Class Structure
Attributes used to define Reflected Units

Distributed Eagle FOM
(Partial - Ground Mover)

OBJECT	ATTRIBUTE
MILITARY-UNITS	Battlefield Operating System
	Higher Hdq's name
	Depth of unit (meters)
	Direction of movement of the unit
	Disaggregated boolean
	Echelon
	Percent Effective
	Effectiveness State
	Frontage of Unit (meters)
	Latitude
	Longitude
	Name
	Operational Activity
	Orientation of weapons
	Phantom boolean
	Purged boolean
	Quantity of Sytems on-hand by type
	Route segment
	Side
	Size
	Systems requirements code
	System configuration
	Task
	Unit Type
GROUND-MOVERS	Air Defense Controller
	Air Defense Network boolean
	Air Defense Status
	Assignment
	Command Assignment
	Command Unit boolean
	Indirect Fire Systems on-hand
	Number of Indirect Fire Units
	Prioritized Enemy List
	Signature - counter battery
	Signature - counter mortar
	Signature - combat
	Signature - communications
	Previously detected boolean
	Signature - IR
	Signature - Moving Target Radar
	Signature - photo
	Net speed from last time step
	System weight factor

JTFp FOM
(Partial - Aggregate Ground Player)

OBJECT	ATTRIBUTE
Player	entity name
	federate id
	affiliation
	motion type
	voice nets
	jtids nets
	trap tre
	comander type
Aggregate Entity	radar cross section
	radar detectable
	elint detectable
	comint detectable
	ir detectable
	photoint detectable
	air to air engageable
	surf to air engageable
	air to surf engageable
	surf to surf engageable
	composition
Dead Reckoned Players	time at last cse change
	lat at last cse change
	lng at last cse change
	alt at last cse change
	cse at last cse change
	hspd at last cse change
	vspd at last cse change
Aggregate Ground Player	depth
	front
	orientation

Number of Attributes to define a typical ground combat unit in Eagle: ~ 400

Number of Attributes to reflect units in Distributed Eagle:

	Define	Update
Ground Movers	43	31
Air Maneuver	35	26
Fixed Wing	33	22

Number of Attributes to reflect Aggregate Ground Units in JTFp:
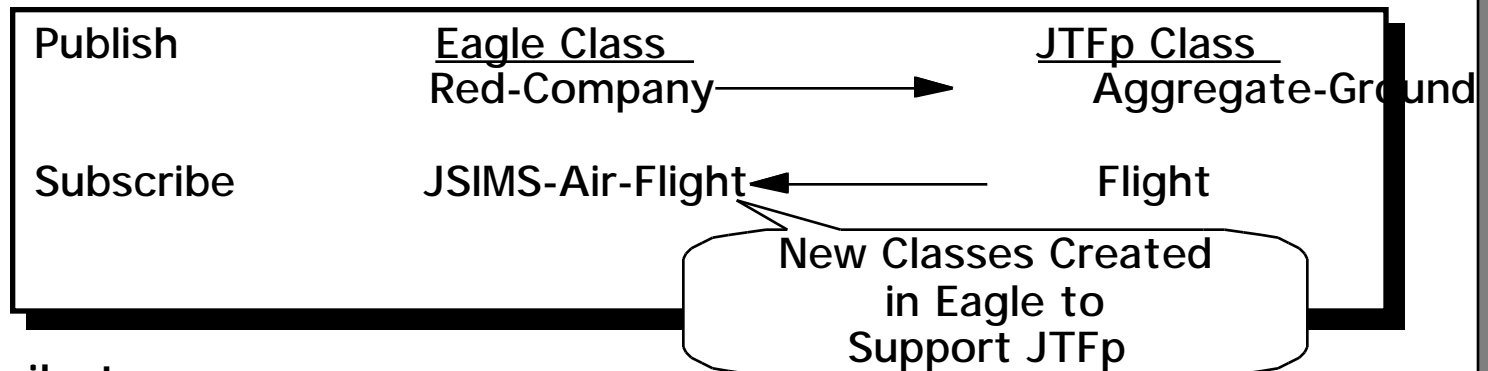
	Define	Update
Ground Movers	29	17

Attributes used for detection's

Eagle modifications to support the JTFp Object Class and Attributes

O Translate the Eagle combat units & attributes to conform to the JTFp FOM and JTFp units & attributes to Eagle.

- Class structure:

Publish	Eagle Class	JTFp Class
	Red-Company ⟶	Aggregate-Ground
Subscribe	JSIMS-Air-Flight ←	Flight

New Classes Created
in Eagle to
Support JTFp

Attributes:

	Eagle ⟷	JTFp
Attribute Names:	a-side	affiliation
Enumerated types:	M1	5
Data Translation:	xy (1)	Lat & Lon (2)
New Attributes:	<N/A>	Motion Type
Methodology:	Time Step Location	Dead Reckoning
Data Types	Lisp Symbol	Float etc

Contexts
Eagle & the High Level Architecture

O **Class Structures**

❹**Interactions**

O **Summary**

<u>Distributed Eagle</u>
Shooting
Communications
Data Base Consistency
DIS interactions
Surrogate C4I

<u>JTFp</u>
Federation Management
Shooting
Communications
Environmental

<u>Eagle MCSP Beta</u>
Simulation Management
Communications
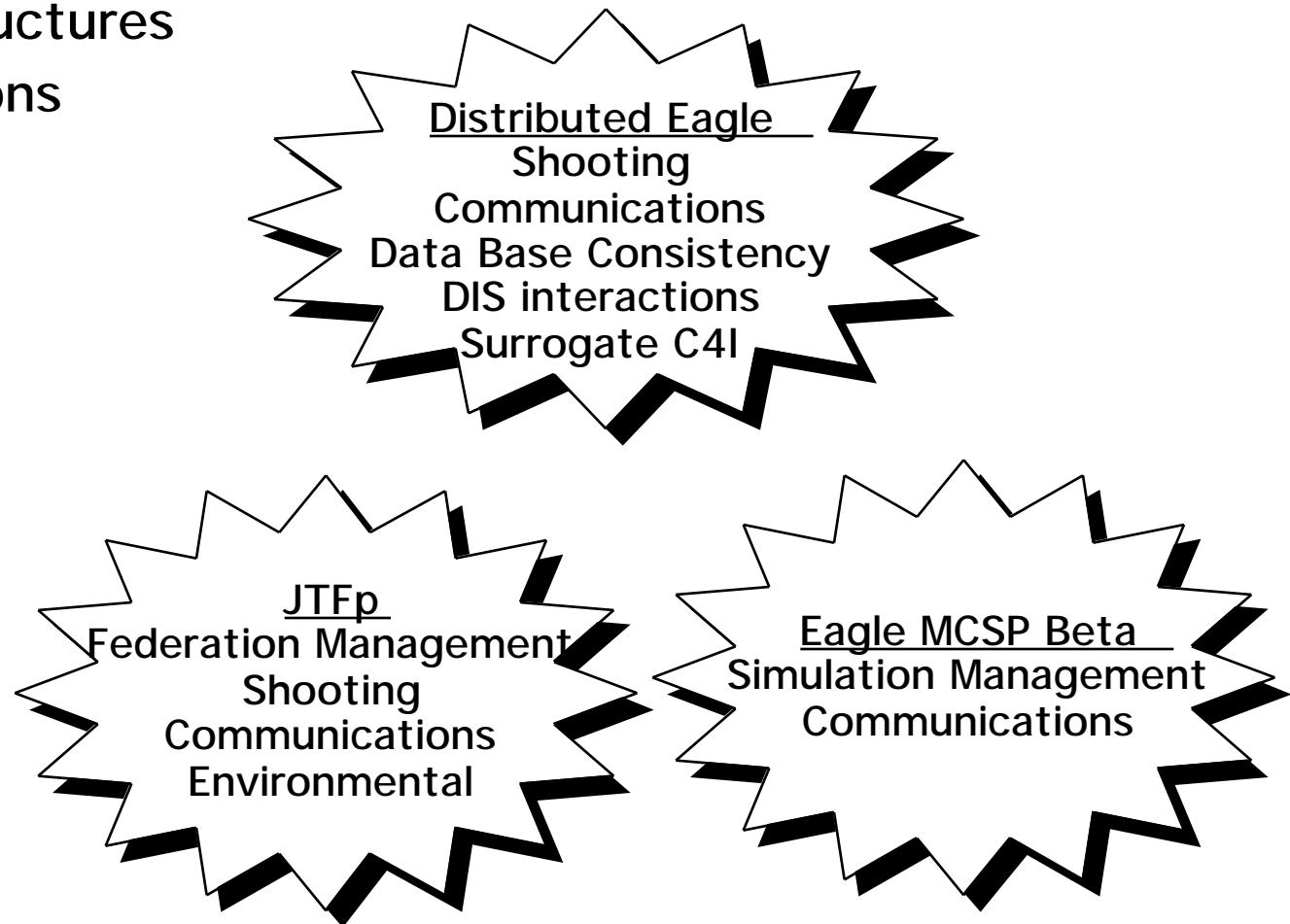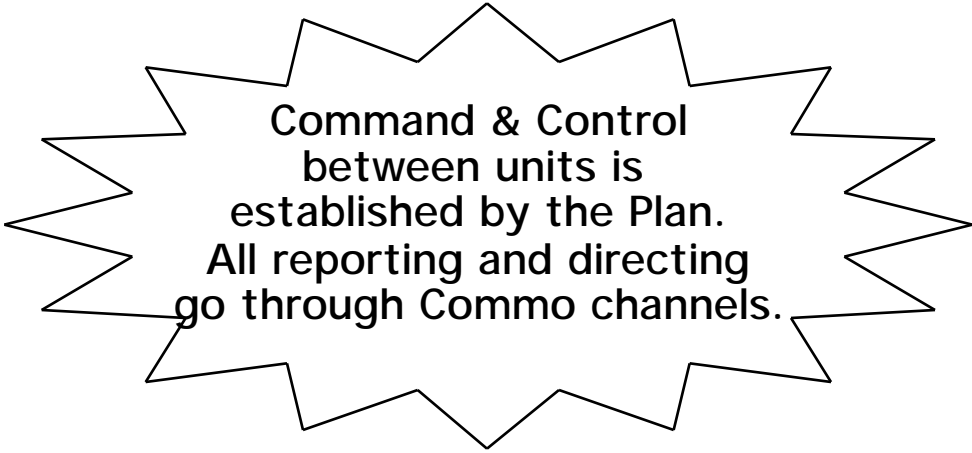
Distributed Eagle Interaction Structure
23 interaction types - total with subtypes: 65

O **Unit Interactions**

- Detection (implicit)

- Direct Fire

- Indirect Fire

- Air to ground

- Ground to air

- Communications

> Command & Control
> between units is
> established by the Plan.
> All reporting and directing
> go through Commo channels.

O **Service Interactions**

- Event Queue Management

  - Add/remove events

- Control Measures Database consistency

  - Create CM

- Terrain Database consistency

  - false targets

  - register engr work

- Attrition

  - Ammo use

  - Suppression

JTFp Interactions that involve Eagle

o **Unit Interactions**
- **Detection (implicit)**
- **Indirect Fire**
- **Air to surface**
- **Surface to air**
- **Communications**

o **Federation Management Interactions**
- **Initialization**

o **Environmental**
- **LOS**

Interaction	Initiating	Receiving
TBM Warming	Player	Eagle Commo Manager - Player
TBMLaunchAlert	Player	Eagle Commo Manager- Player
Situation Report	Player - Eagle Commo Manager	Player (JTF HQ)
RequestAirSupport	Player - Eagle Commo Manager	Player (JTF HQ)
AirToAggregate GroundEngage	Player	Eagle Attrition Manager
DiscreteGroundToAirEngage	Player	Eagle Attrition Manager
AggregateGround ToAirEngage	Eagle Attrition Manager	Player
Get & Return LOS	Eagle Terrain Manager	Surface Cover
Initialize Federation	Federation Status	Eagle Federation Status
Execute Federation	Federation Status	Eagle Federation Status

JTFp has defined 24 Interactions
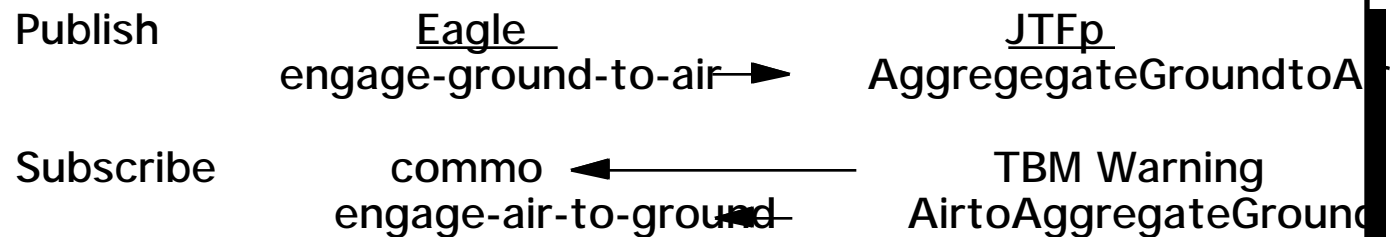Eagle subscribes/published to 10

EAGLE To MCSP Interactions
10 interactions defined (9 to MCSP, 1 to Eagle)

**E
A
G
L
E**

**S
I
M**

**Situation/Status Report
Enemy Report
Message Report
Logistics Report
Field Artillery Status Report
Field Artillery Fire Mission Report
Field Artillery Fire Mission Complete Rep
Sensor report**

**Request status
Order changetask, halt, moveout
Frag order - (who, what, when, where)
Execute frag order
Fire mission
(Controller directives: run, pause, speed)**
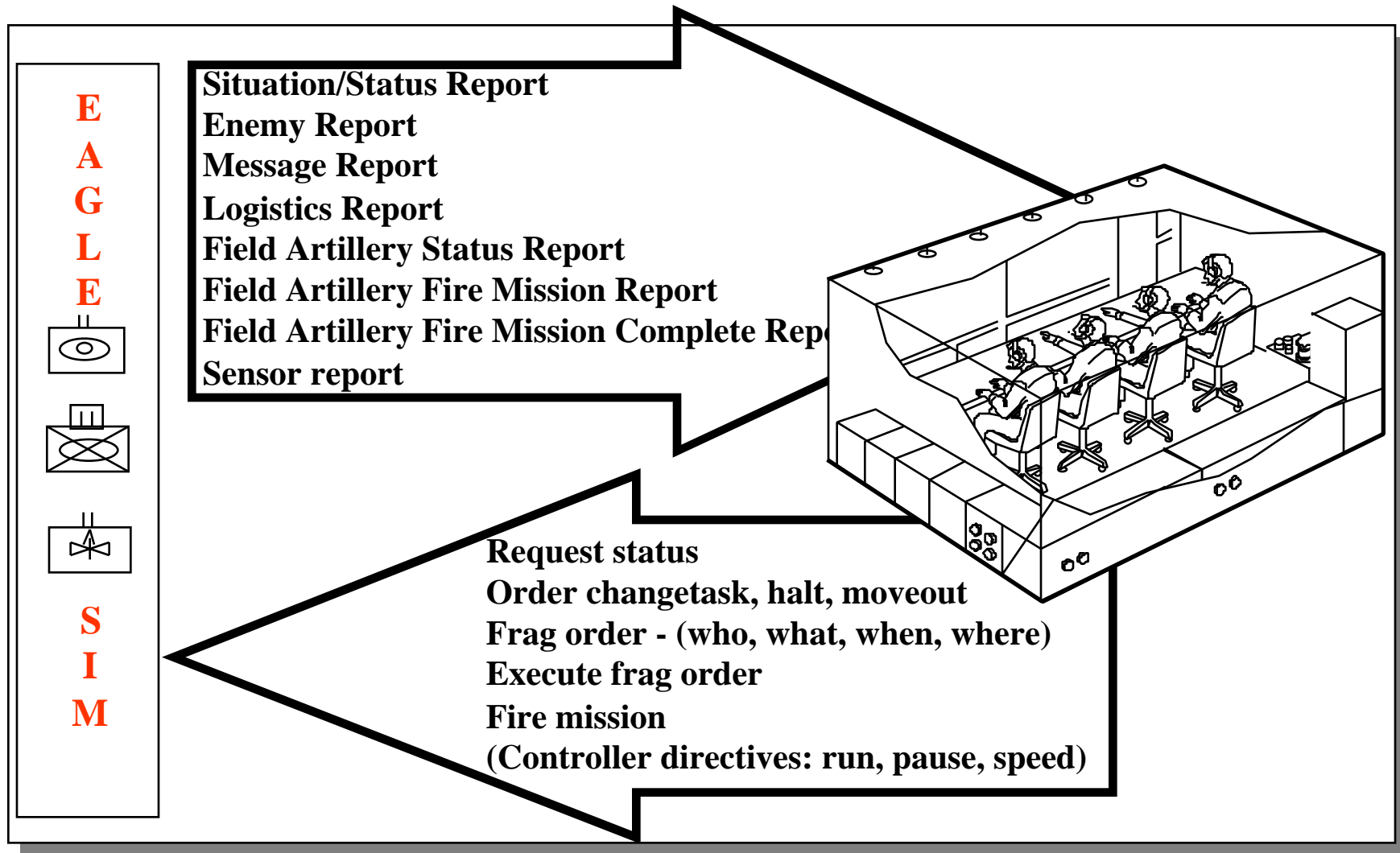
Eagle modifications to support the JTFp Interactions and Parameters

O Translate the Eagle interactions & parameters to conform to the JTFp FOM and JTFp interactions & parameters to Eagle.

- Interactions:

Publish	Eagle	JTFp
	engage-ground-to-air ▶	AggregegateGroundtoAir
Subscribe	commo ◀	TBM Warning
	engage-air-to-ground ◀	AirtoAggregateGround

Parameters:

	Eagle ◀▶	JTFp
Parameter Names:	a-system	weapon_system
Enumerated types:	M1	5
Data Translation:	xy (1)	Lat & Lon (2)
New Attributes:	<N/A>	Launch_quad
Data Types	Lisp Symbol	Float etc.
Data Format	Complex Type	Separate Parameters

Summary

o The Flexibility of the RTI definitions of attributes and parameters allows for multiple participation in unique Federations.

o Nothing (or very little) was common among the 3 federations - yet all 3 can be executing at the same time.

- Declaration of federation(s) causes publication and subscription to unique classes and interactions.

- Unique Federations mean unique attributes/interactions

o Their should be NO generic or reference FOM - to DIS like - more likely the reference FOM is really a ModSaf SOM.

o Experience of trying to influence DIS (aggregate PDU), leads me to believe that reference will be standard, which means inflexibility.